CLAIMS

1. A device for joining substrates which is used for manufacturing a chip size package formed in a way that a semiconductor substrate with plural elements formed thereon and a sealing substrate for individually sealing said elements are joined together and diced into a plurality of said chip size packages having said individual sealed element, comprising:

a substrate supplying section for supplying said semiconductor substrate and said sealing substrate;

a transcribing sheet supplying section for supplying an elastic transcribing sheet on which adhesive is coated;

a transcribing sheet pressurization section for pressurizing together a joint surface of said transcribing sheet coated with said adhesive and a joint surface of said sealing substrate;

a transcribing sheet peeling section for peeling said transcribing sheet from said sealing substrate so as to form a layer of said adhesive on said sealing substrate;

a parallelism adjusting section for adjusting parallelism of said joint surface of said semiconductor substrate and said joint surface of said sealing substrate on which said adhesive layer is formed;

a substrate joining section for adjusting positions of said semiconductor substrate and said sealing substrate, and then joining said semiconductor substrate and said sealing substrate which are adjusted their positions; and

a substrate conveying mechanism for conveying said semiconductor substrate, said sealing substrate and said transcribing sheet among said respective sections.

2. A device for joining substrates as described in claim 1, wherein said chip size package is a solid state imaging device,

and said sealing substrate is formed of a transparent material.

3. A device for joining substrates as described in claim 2, wherein said element is an image sensor, and said sealing substrate is constituted of a glass substrate and plural flame-like spacers which individually surround said image sensors.

4. A device for joining substrates as described in claim 1, wherein said transcribing sheet peeling section comprises:

a peeling roller provided close to one end of said sealing substrate which is set at a position for peeling said transcribing sheet;

a long adhesive tape being hanged on said peeling roller and contacting to one end of said transcribing sheet;

a roller moving mechanism for moving said peeling roller from a position near said one end of said sealing substrate to a position near another end of said sealing substrate; and

a winding section for winding said adhesive tape in synchronization with move of said peeling roller by said roller moving mechanism so as to keep a constant angle between said peeled transcribing sheet and said joint surface of said sealing substrate.

5. A device for joining substrates as described in claim 4, said transcribing sheet peeling section further comprising:

a roller clearance adjusting mechanism for moving said peeling roller so as to adjust clearance between said peeling roller and said transcribing sheet before peeled, in a direction perpendicular to said joint surface of said sealing substrate which is set at a position for being joined with said transcribing sheet.

6. A device for joining substrates as described in claim 4, a clearance between an outer peripheral surface of said adhesive tape hanged on said peeling roller and said transcribing sheet being 0.1 mm or less when said transcribing sheet is peeled.

7. A device for joining substrates as described in claim 4, wherein said peeling roller has a diameter of between 15 mm and 20mm.

8. A device for joining substrates as described in claim 1, wherein said transcribing sheet is an antistatic plastic film.

9. A device for joining substrates as described in claim 1, wherein said transcribing sheet pressurization section pressurizes said transcribing sheet through a cushion.

10. A device for joining substrates as described in claim 9, wherein said cushion is a sponge rubber having hardness of ASKER-C 20-40.

11. A device for joining substrates as described in claim 1, said parallelism adjusting section comprising:

a plurality of substrate clearance measurement section for measuring clearances between said joint surface of said semiconductor substrate and said joint surface of said sealing substrate at plural measurement points; and

a substrate inclination adjusting section for adjusting inclinations of said semiconductor substrate or said sealing substrate based on measurement result from said substrate clearance measurement section.

12. A device for joining substrates as described in claim 11, wherein said substrate clearance measurement section comprises:

a plurality of transmission illuminating devices for emitting transmission light to said measurement points between said joint surface of said semiconductor substrate and said joint surface of said sealing substrate;

a plurality of substrate clearance imaging devices provided corresponding to said transmission illuminating devices, for imaging said semiconductor substrate and said sealing substrate which are illuminated at said measurement points; and

a substrate clearance calculating device for calculating lengths of said clearances between said joint surfaces of said semiconductor substrate and said sealing substrate at said measurement points by analyzing image data from said plurality of substrate clearance imaging devices.

13. A device for joining substrates as described in claim 12, wherein said transmission illuminating device has a converging angle of 1° or less.

14. A device for joining substrates as described in claim 12, wherein said substrate clearance imaging device has a telecentric lens which only parallel lights can enter.

15. A device for joining substrates as described in claim 11, wherein said substrate clearance measurement section has a laser measurement device for measuring distance between said joint surface of said semiconductor substrate and said joint surface of said sealing substrate at predetermined points.

16. A device for joining substrates as described in claim

11, wherein said substrate inclination adjusting section comprises:

a plurality of actuators positioned corresponding to said measurement positions of said substrate clearance measurement section, for moving plural predetermined positions of said semiconductor substrate or said sealing substrate in perpendicular direction of said joint surface;

an actuator controller for controlling said actuators based on measurement result from said substrate clearance measurement section; and

a plate supporting mechanism for swingably supporting either one of said semiconductor substrate and said sealing substrate to follow the other substrate when joining said semiconductor substrate and said sealing substrate, with swing reference of said supported substrate being in the same plane as said joint surface of said supported substrate.

17. A device for joining substrates as described in claim 1, wherein said parallelism adjusting section comprises:

a plurality of displacement amount measuring section for measuring displacement amounts of said joint surface of said semiconductor substrate and said joint surface of said sealing substrate at plural measurement points from predetermined reference positions in a direction perpendicular to said joint surfaces; and

a substrate inclination adjusting section for adjusting inclinations of said semiconductor substrate or said sealing substrate based on measurement result from said displacement amount measuring section.

18. A device for joining substrates as described in claim 17, wherein said substrate inclination adjusting section

comprises:

a plurality of actuators positioned corresponding to said measurement positions of said displacement amount measuring section, for moving plural predetermined positions of said semiconductor substrate or said sealing substrate in perpendicular direction of said joint surface;

an actuator controller for controlling said actuators based on measurement result from said displacement amount measuring section; and

a plate supporting mechanism for swingably supporting either one of said semiconductor substrate and said sealing substrate to follow the other substrate when joining said semiconductor substrate and said sealing substrate, with swing reference of said supported substrate being in the same plane as said joint surface of said supported substrate.

19. A device for joining substrates as described in claim 1, wherein said parallelism adjusting section comprises:

a support plate for holding said semiconductor substrate or said sealing substrate; and

a plate holding mechanism for holding said support plate in a swingable manner with said semiconductor substrate and said sealing substrate contacting each other, and for fixing said support plate said supported substrate swings to follow said other substrate.

20. A device for joining substrates as described in claim 19, wherein said plate holding mechanism comprises:

a spherical shaft integrated with said support plate;

a spherical receiver for swingably supporting said spherical shaft; and

an air pump for sending air in between said spherical shaft

and said spherical receiver so as to allow movement of said spherical shaft, and for sucking said air from between said spherical shaft and said spherical receiver so as to fix said spherical shaft on said spherical receiver.

21. A device for joining substrates as described in claim 1, wherein said substrate joining section comprises:

an underside support plate for holding said sealing substrate or said semiconductor substrate;

a position adjusting section for moving said underside support plate in a plane direction and a rotational direction so as to adjust positions of said sealing substrate and said semiconductor substrate;

a topside support plate positioned above and faced to said underside support plate, for holding said sealing substrate whose position is adjusted so as to face said underside support plate; and

a pressure mechanism for pressing said underside support plate toward said topside support plate when said semiconductor substrate and said sealing substrate are joined.

22. A device for joining substrates as described in claim 21, wherein said pressure mechanism has a pressure control mechanism for controlling pressure of said pressure mechanism so as not to exceed a predetermined value.

23. A device for joining substrates as described in claim 1, wherein said adhesive on said transcribing sheet is light-delayed curing adhesive, and said device for joining substrates further comprises an illumination station for irradiating light to start the curing of said adhesive before said adhesive is transcribed onto said sealing substrate.

24. A device for joining substrates as described in claim 1, wherein said device for joining substrates is set inside a clean booth which is sealed from outside.

25. A method for joining substrates which is used for manufacturing a chip size package formed in a way that a semiconductor substrate with plural elements formed thereon and a sealing substrate for individually sealing said elements are joined together and diced into a plurality of said chip size packages having said individual sealed element, comprising steps of:

(a) supplying a semiconductor substrate;

(b) supplying a sealing substrate;

(c) supplying an elastic transcribing sheet on which adhesive is coated;

(d) pressurizing together a joint surface of said transcribing sheet coated with said adhesive and a joint surface of said sealing substrate;

(e) peeling said transcribing sheet from one end of said sealing substrate with maintaining a constant curvature so as to form a layer of said adhesive on said sealing substrate;

(f) adjusting parallelism of said joint surfaces of said semiconductor substrate and said sealing substrate;

(g) adjusting positions of said semiconductor substrate and said sealing substrate; and

(h) joining said semiconductor substrate and said sealing substrate which are adjusted their positions.

26. A method for joining substrates described in claim 25, wherein said step (f) further includes steps of:

(f1) measuring clearances between said joint surface of

said semiconductor substrate and said joint surface of said sealing substrate at plural measurement points; and

(f2) adjusting inclinations of said semiconductor substrate or said sealing substrate based on result of said measurement.

27. A method for joining substrates described in claim 25, wherein said step (f) further includes steps of:

(f1) measuring respective positions of said joint surface of said semiconductor substrate and said joint surface of said sealing substrate at plural measurement points in a direction perpendicular to said joint surfaces;

(f2) calculating parallelism between said semiconductor substrate and said sealing substrate by comparing said measured positions at said plural measurement points to preset reference positions; and

(f3) adjusting inclinations of said semiconductor substrate or said sealing substrate based on result of said calculation.

28. A method for joining substrates described in claim 25, wherein said step (f) further includes steps of:

(f1) movably holding a movable plate which holds said semiconductor substrate or said sealing substrate;

(f2) contacting said semiconductor substrate to said sealing substrate each other such that said substrate held by said movable plate follows said other substrate held by a stationary plate; and

(f3) fixing said movable plate.

29. A method for joining substrates described in claim 26, wherein said step (f1) further includes steps of:

(f11) making said joint surfaces of said semiconductor substrate and said sealing substrate face each other with predetermined clearance;

(f12) emitting transmission light to said measurement points between said joint surface of said semiconductor substrate and said joint surface of said sealing substrate, and imaging said semiconductor substrate and said sealing substrate which are illuminated at said measurement points; and

(f13) calculating lengths of said clearances between said joint surfaces of said semiconductor substrate and said sealing substrate at said measurement points by analyzing image data obtained from said imaging.

30. A method for joining substrates described in claim 26, wherein said step (f1) further includes steps of:

(f11) making said joint surfaces of said semiconductor substrate and said sealing substrate face each other with predetermined clearance;

(f12) detecting lengths of said clearances between said joint surfaces of said semiconductor substrate and said sealing substrate such that plural light emitting sections respectively emit laser beam to go through between said joint surfaces of said semiconductor substrate and said sealing substrate toward corresponding light receiving section.

31. A method for joining substrates described in claim 26, wherein said step (f3) further includes a step of swinging either one of said semiconductor substrate and said sealing substrate to follow the inclination of said other substrate in the same plane as said joint surface of said substrate.